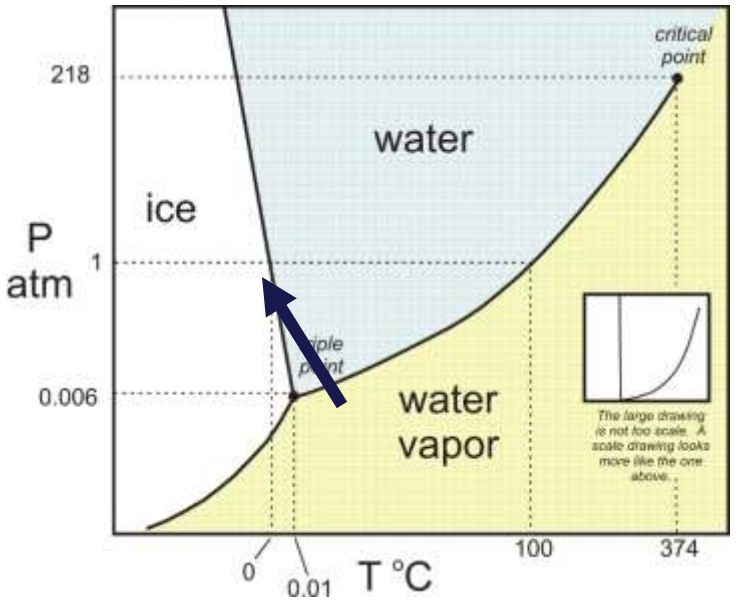
Bell Work
12-Dec-2017

__Zn + __HCl → __$ZnCl_2$ + __H_2

I. What is the molar ratio of Zn: $ZnCl_2$?

II. What is the name of the phase change happening in the arrow on the phase diagram?

III. If temperature is O ˚C and pressure is 218atm, what state is H_2O (?)



Agenda

Lewis Dot Structure – Atoms (recap),
Compounds
Steps 1-4

Objective:
You will KNOW how to draw Lewis Structures of simple common compounds and ions

Turn In
12-Dec-2017

Balancing Equations #1-60, work

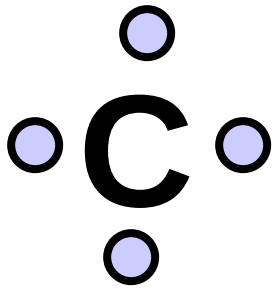
Drawing Lewis Structures

We learned how to draw Lewis Dot structures of ions a few months ago.

To draw a Lewis dot structure of an ion simply draw the elements symbol and then distribute electrons around the symbol.

Take Carbon:

Total # of valence e^- (equals group #): 4



You try: F, O, Mg

You have 30 sec.

Drawing Lewis Structures

Lewis structures are used to identify the types of bonds (single —, double ═, triple ≡) formed between atoms in a molecule or polyatomic ion.

Drawing the Lewis structure is not difficult ☺
IF you follow the exact process that I give you.

Now for the steps…

Drawing Lewis Structures

1. Add up the valence electrons from all atoms

H_2O Ve^- :

1 from each H & 6 from O

So 2(1) + 1(6) =8

CO_2 Ve^-:

4 from C & 6 from each O

So 1(4) + 2(6) = 16

You try: SO_2 and SiO_2

SO_2 Ve^- = 1(6) + 2(6) = 18

SiO_2 Ve^- = 1(4) + 2(6) = 16

Drawing Lewis Structures

1. Add up the valence electrons from all atoms

For a cation (+), subtract 1 electron for each positive charge

NH_4^+ : 1(5) + 4 (1) -1 = 8 Ve^-

For an anion (-), add 1 electron for each negative charge

CN^- : 1(4) + 1(5) + 1 = 10 Ve^-

You try: NO_2^-, CO_3^{2+}

NO_2^- Ve^- = 1(5) + 2(6) + 1 = 18

CO_3^{2+} Ve^- = 1(4) + 3(6) -2 = 20

Drawing Lewis Structures

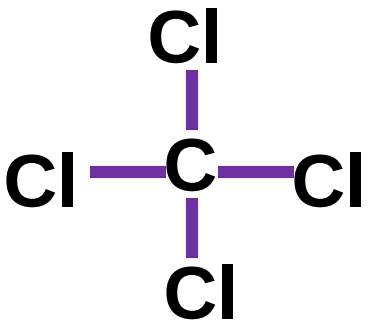
2. Draw a skeleton structure showing the chemical symbols for each atom. Connect the appropriate atoms using a single bond –, each line represent 2 e-.

Sometimes (but not always) the order in which the formula is written

HCN: H–C–N

Central atom (written first) surrounded by other atoms

CCl_4 :



Drawing Lewis Structures

3. Add electron pairs, ∞,to the atoms bonded to the central atom first until each has an octet (8) of e^-.

Remember, H only gets $2e^-$ so once it bonds it has its $2e^-$.

H — Cl

IF there are any unused e^-, *<u>place all of the leftovers on the central atom</u>*.

Pre-AP

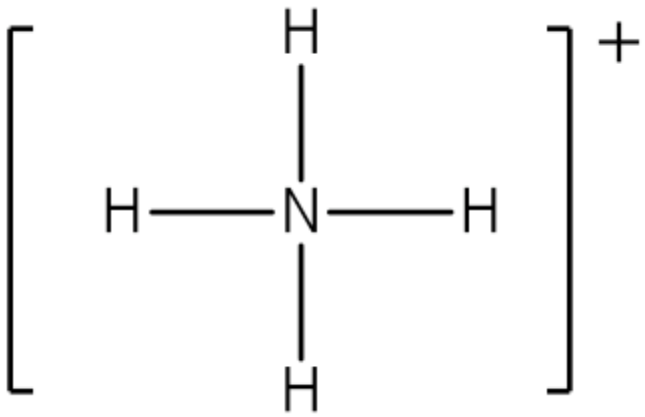
Note: This sometimes gives the central atom more than eight e^-.

Drawing Lewis Structures

4. Do all atoms that need an octet have one?
Did you use all of the valance electrons?

If you answered yes then you are done.

Note: if you are drawing an ion (charged particle) the you must put the structure in brackets and label the charge NH_4^+



Practice

Complete the following for Br_2

#of Valence electrons :_____

# of lone pairs (electrons):_____ ∞

#of bonding pairs ( ): _____ —

Structure:

Br Br

Drawing Lewis Structures

Lets try one: H_2O

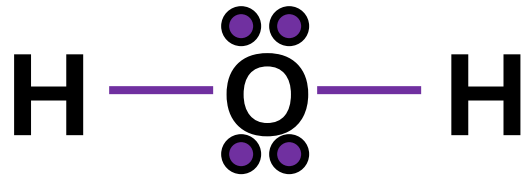
Number of Ve^- :

$2(1) + 1(6) = 8e^-$

$-4e^-$

$-4e^-$

0



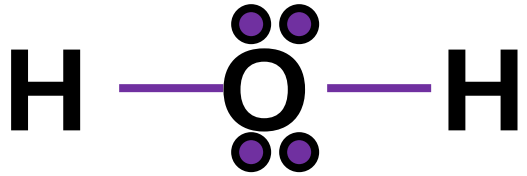
Did we use all the Ve^-?

Do all the atoms that need an octet have one?

Yesss, you have done good job!!!

Drawing Lewis Structures

H_2O



We have
2 lone e- pairs
2 bonding pairs

Drawing Lewis Structures

If (and only if) there are not enough e^- to give the central atom an octet, try multiple bonds.

Use one (or more) unshared pairs of e^- to form double (or triple) bonds: HCN

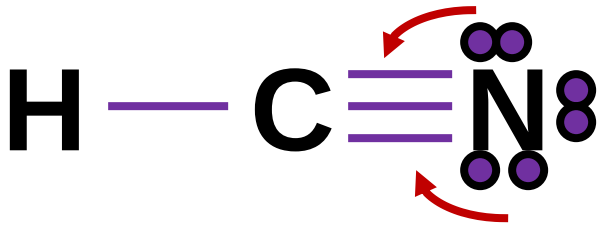
Number of Ve^- :

1+ 4 + 5 = 10Ve^-

-4e^-

-6e^-

-0Ve^-



Oops Carbon does not have an octet…

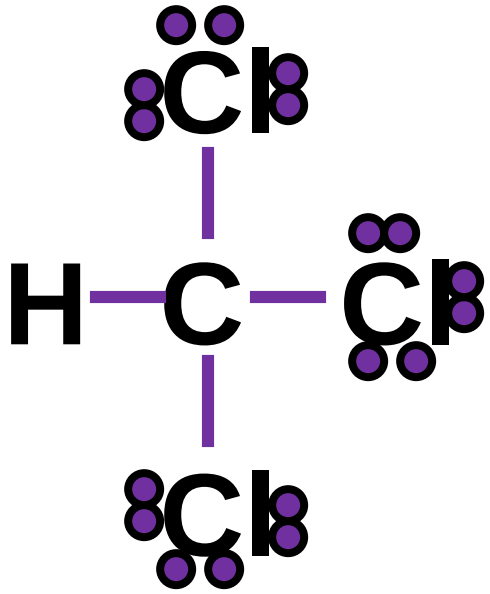
Now both nitrogen and carbon have an octet

Drawing Lewis Structures

Example: Draw the Lewis structure for $CHCl_3$

# of Ve^- = 4 + 1 + 3(7) = 26Ve^-

C = central atom



-8e^-

-18e^-

0Ve^-

We have used all the Ve- and every atom that needs and octet has one

Drawing Lewis Structures

Example: Draw the Lewis structure for PO_4^{3-}.

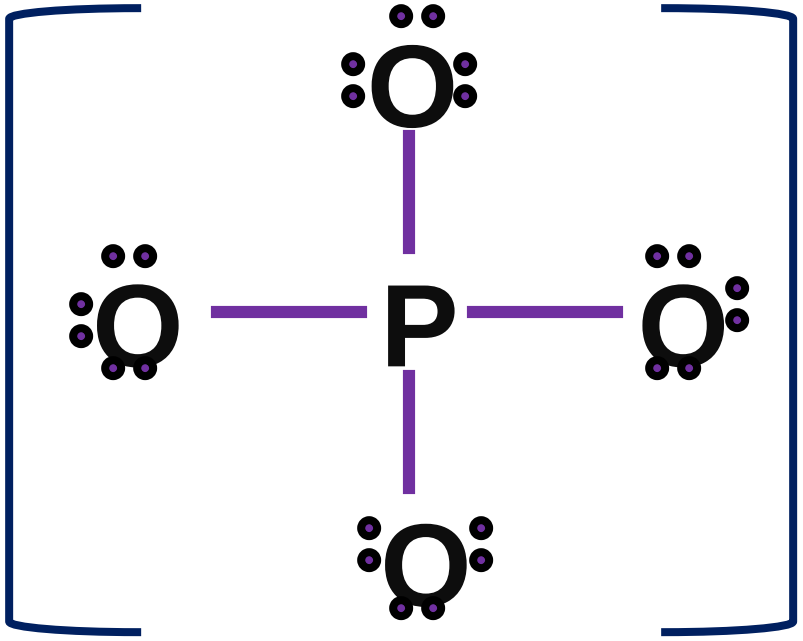
 # valence electrons = 5 + 4(6) + 3 = 32Ve$^-$

P = central atom

-8e$^-$

-24e$^-$

-0Ve$^-$



-3

Don't forget to show the charge of the ion, too.

Drawing Lewis Structure

With your partner write the steps for drawing Lewis structures. Note any special manipulations you may need to do to get all atoms an octet and use all your Ve^-.

1.

2.

3.

4.

Small Group Practice

In your lab groups please complete the Lewis structures of the following:

Carbon dioxide

Elemental iodine

CH_3Cl

Sulfate ion* **(remember the charge)**

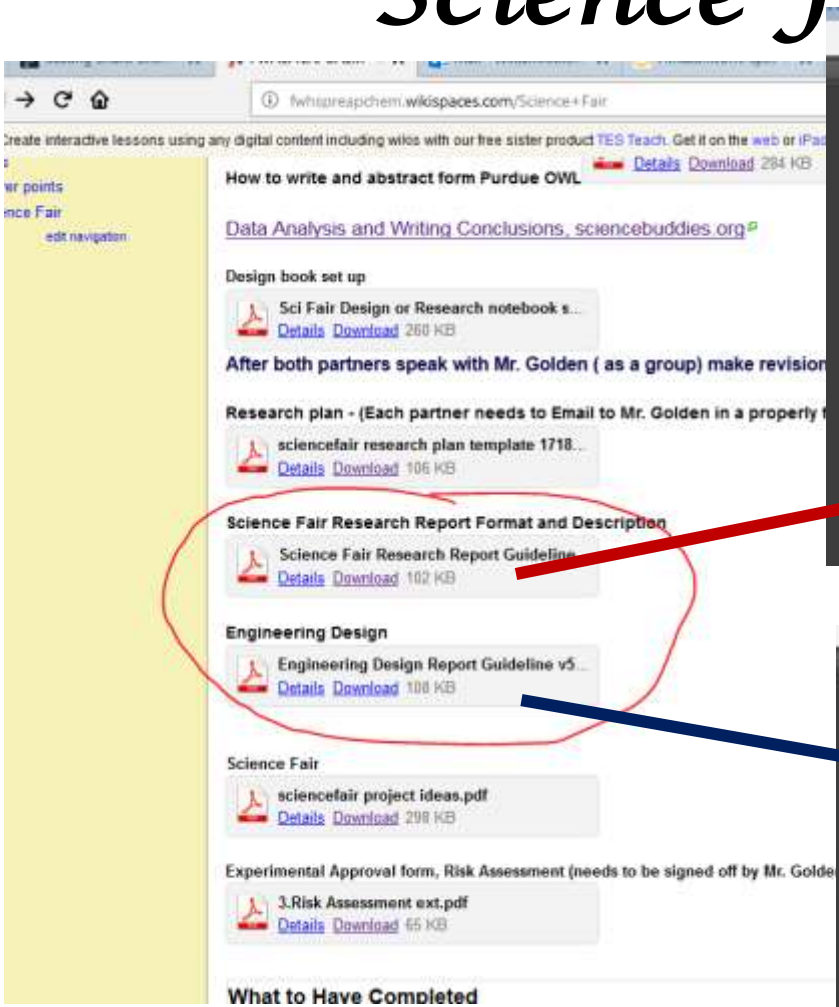
Bell Work
13-Dec-2017

What amount of energy is produce when a 150nm wavelength of light is emitted?

Objective:

You will KNOW how to predict the molecular geometry and bond angles of simple compounds based on their Lewis Structure

Science Fair Report



Science Fair Research Report Guideline

Developed using content directly from:

Writing a Scientific Research Paper.
columbia.edu. columbia.edu/cu/biology/ug/research/paper.html

Science Fair Research Report TEMPLATE. "
sequoiasecondary.org. sequoiasecondary.org/.../ScienceFair/Science%20Fair%20Research

Freeman, Dennis M. "Guide for Writing Scientific Research Paper."
umech.mit.edu, http://umech.mit.edu/freeman/6.021J/2000/writing.pdf

Engineering Design Report Guideline

Please be aware additional section may be added or removed specific to the project at hand

Abstract/ Executive Summery, (1 paragraph)
- Microcosm of entire paper
- Contains essential key information from each section *only* – it is brief!
- Covers design highlights
- Gives brief explanation of problem
- How design solves problem
- Presents the main evaluation and conclusions of design

I. Problem Definition

i. Introduction: Problem Statement (1-2 paragraphs)
- Explains the problem to be solved, who are the stakeholders
- Explains importance of the problem (Why does it matter? Why is more information needed?)
- States specific, not detailed, measures of success

ii. Literature Research/ Technical Review:
- Summarizes and *evaluates* the literature that you have used in your study by considering:
  - How that literature has contributed to your design

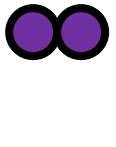
Bell Work
14-Dec-2017

Describe the cathode ray tube experiment in detail and the findings.

What were the finding of the Gold Foil Experiment, who did it?

Practice

Complete the following for SiO
#of Valence electrons :____
# of lone pairs (electrons):_____
#of bonding pairs ( ): _____
Structure:



Si O

Drawing Lewis Structures Your Turn

Draw the Lewis structure for PCl_3

Draw the Lewis structure for NO_2^-

Draw the Lewis structure for XeF_2

Drawing Lewis Structures
Ion practice

a) BH_2^-

b) SO_3^{2-}

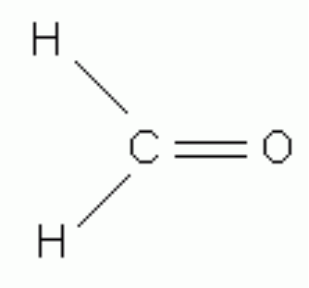
c) ClF_4^+ **(Cl gets more than an octet)**

d) ClO_3^-

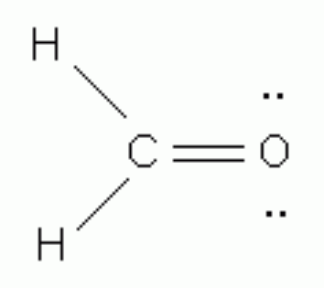
Drawing Lewis Structures
Ion practice

Which is the correct structure for CH_2O?

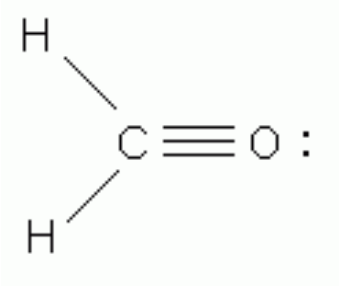
1



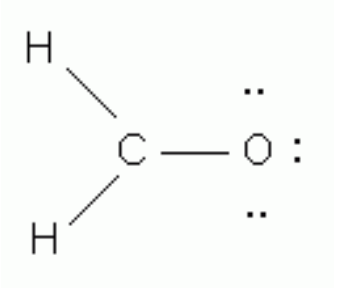
2



3



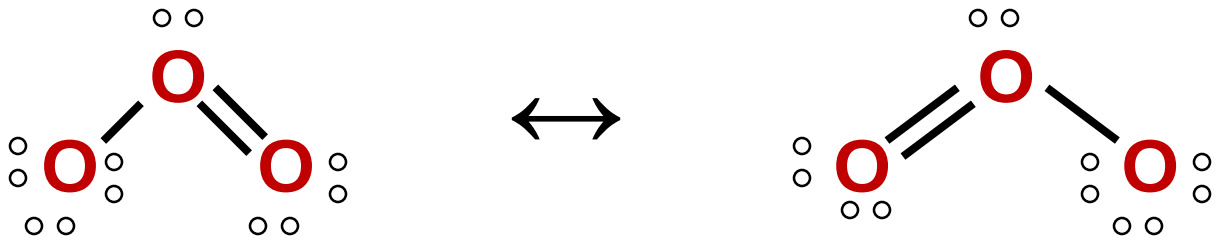
4



Drawing Lewis Structures

When writing the Lewis structure for ozone we could easily have put the double bond between the other two oxygens.

Ozone (O_3):

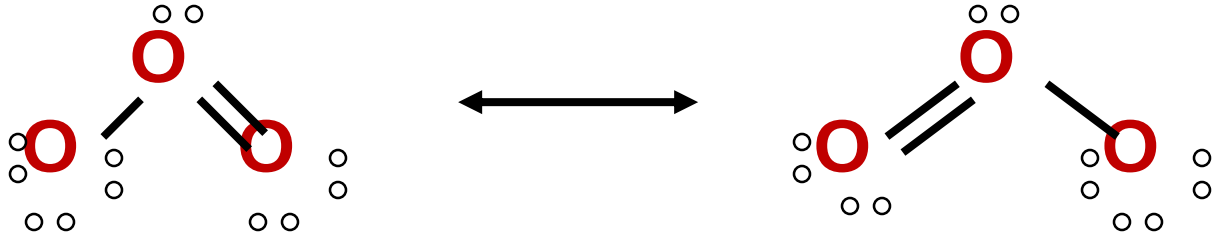


Drawing Lewis Structures

These two structures are equivalent except for the placement of electrons.

Resonance structures

Resonance structures for ozone:



Drawing Lewis Structures

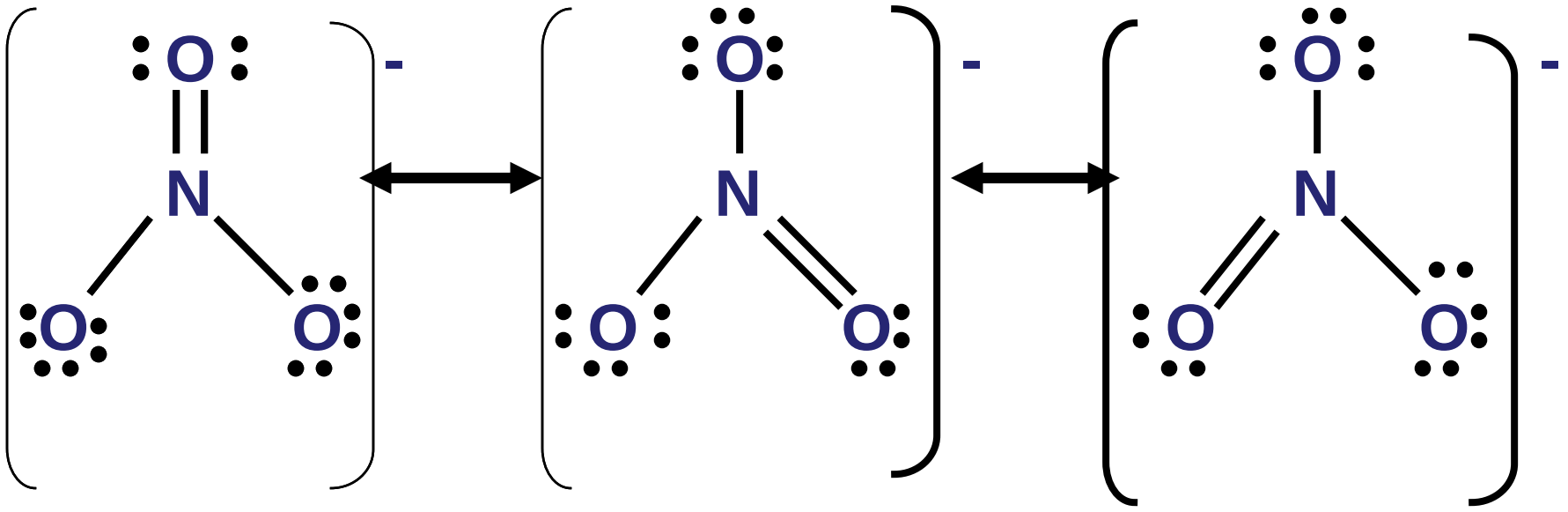
Resonance structure: **one of a group of Lewis structures used to describe a molecule that cannot be accurately depicted using a single Lewis structure**

NOTE: The real molecule is a "hybrid" or average of the resonance structures. It does not "flip" back and forth between the possible structures.

Drawing Lewis Structures

Example: Draw all possible resonance structures for NO_3^-.

 # valence electrons = 5 + 3(6) + 1 = 24



Review of Chemical Bonds

There are 3 forms of bonding:

ionic —complete *transfer* of 1 or more electrons from one atom to another (one loses, the other gains) forming oppositely charged ions that attract one another (metal and non-metal*)

Covalent —some valence electrons *shared* between atoms (non-metal and non-metal)

Metallic – holds atoms of a metal together (two or more metals)

***short cut works most of the time but not always**

The type of bond can *usually* be calculated by finding the difference in electronegativity of the two atoms that are going together.

Page 303 Table 12.1

1A	2A											3A	4A	5A	6A	7A
							H 2.1									
Li 1.0	Be 1.5											B 2.0	C 2.5	N 3.0	O 3.5	F 4.0
Na 0.9	Mg 1.2	3B	4B	5B	6B	7B	8B			1B	2B	Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0
K 0.8	Ca 1.0	Sc 1.3	Ti 1.5	V 1.6	Cr 1.6	Mn 1.5	Fe 1.8	Co 1.8	Ni 1.8	Cu 1.9	Zn 1.6	Ga 1.6	Ge 1.8	As 2.0	Se 2.4	Br 2.8
Rb 0.8	Sr 1.0	Y 1.2	Zr 1.4	Nb 1.6	Mo 1.8	Tc 1.9	Ru 2.2	Rh 2.2	Pd 2.2	Ag 1.9	Cd 1.7	In 1.7	Sn 1.8	Sb 1.9	Te 2.1	I 2.5
Cs 0.7	Ba 0.9	La 1.1	Hf 1.3	Ta 1.5	W 1.7	Re 1.9	Os 2.2	Ir 2.2	Pt 2.2	Au 2.4	Hg 1.9	Tl 1.8	Pb 1.8	Bi 1.9	Po 2.0	At 2.2

<1.0 | 1.0–1.4 | 1.5–1.9 | 2.0–2.4 | 2.5–2.9 | 3.0–4.0

Figure 9.9 Electronegativity values for the elements according to Pauling. Trends for electronegativities are the opposite of the trends defining metallic character. Nonmetals have high values of electronegativity, the metalloids have intermediate values, and the metals have low values.

Electronegativity Difference

If the difference in electronegativities is between:

1.7 to 4.0: Ionic

0.3 to 1.7: Polar Covalent

0.0 to 0.3: Non-Polar Covalent

Example: NaCl
Na = 1.01, Cl = 2.83
Difference is 1.82, so this is an ionic bond!